LA-13870-PR Progress Report
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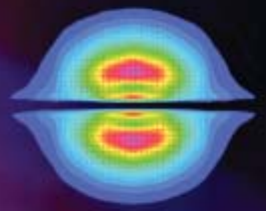

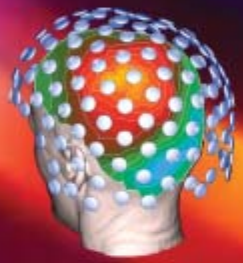

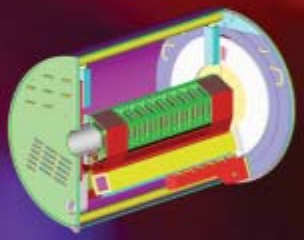

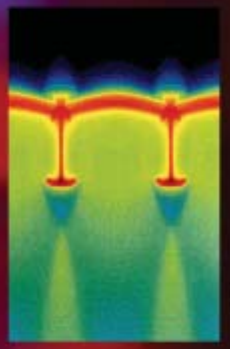

Physics Division Progress Report

January 1, 1999–December 31, 2000

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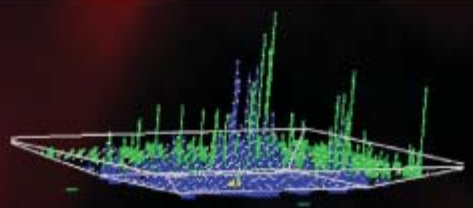
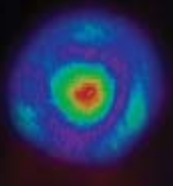
NNSA
National Nuclear Security Administration





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On the cover:
This cover design illustrates the wide and diverse range of projects that we pursue in the Physics Division:

(1) A simple eddy current simulation which shows that in a sample with a flaw the current must deviate—which produces the magnetic-field anomaly measured by the superconducting quantum interference device (SQUID).

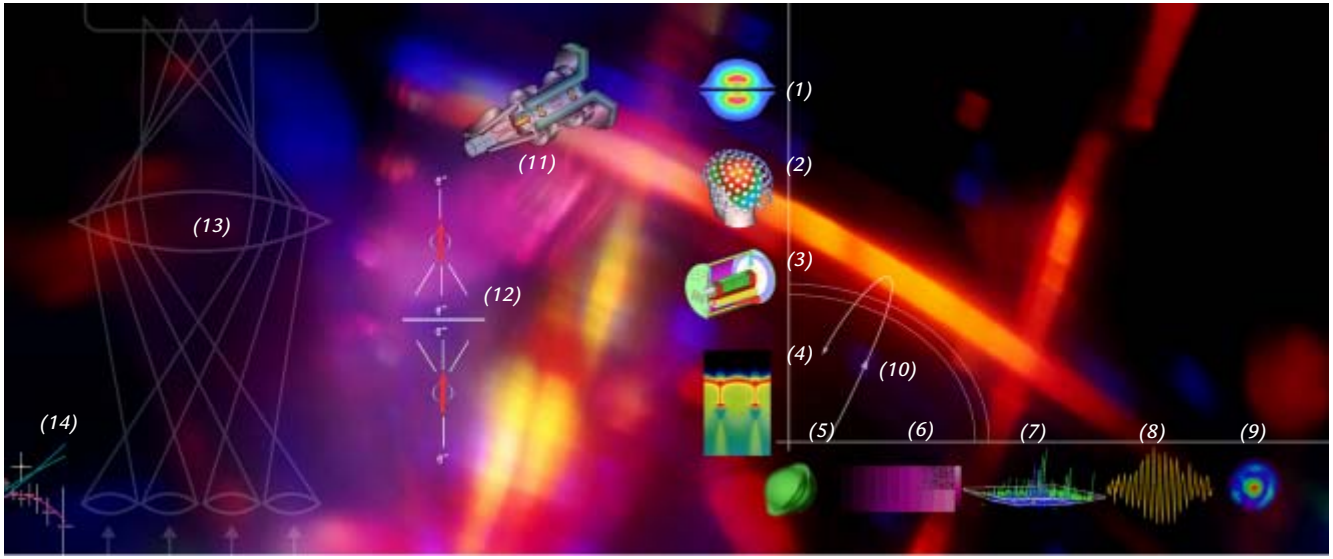
(2) Our whole-head magnetoencephalography (MEG) system uses SQUID sensors to record the magnetic fields produced by active populations of neurons.

(3) A schematic view of the multiplicity and vertex detector (MVD), whose purpose is twofold: to Identify the point at which the colliding particles actually hit each other and to measure the multiplicity and distribution of charged-particle tracks from the collision.

(4) A RAGE simulation of a transverse view through an experimental package showing the development of a 20-μm-wide spike, 30-μm tall above a 15-μm-thick back-plane CH-covered copper package at 3.5 ns. The color scale represents the copper density from 0.1 g/cc in the low-density blow-off to 10 g/cc in the slightly compressed copper spikes and bubbles at 1.5 ns.

(5) One of the stages of the assembly of a double-shell target used in this study of imploding targets with National Ignition Facility (NIF)-like lasers. This image shows the inner capsule surrounded by the foam shell.

(6) An image of inferred areal densities from simulated radiographs made with x-rays (top half of image) and protons (bottom half of the image) for a uranium step wedge.



(7) A typical event in Milagro showing pulse heights from the shower-layer photomultiplier tubes (PMTs) (green) and muon-layer PMTs (blue). The location of the shower core is evident in both layers.

(8) A cross-correlation histogram (CCH) computed during the plateau portion of the response for pairs of ganglion cells at opposite ends of the same bar. Correlations were significant for pairs from the same bar.

(9) A plot of the measured intensity pattern at best focus for the "single hot spot" laser used in our experiments. Its size is similar to one of the hot spots found in the ensemble of hot spots in a random phase plate (RPP) beam.

(10) Lattice quantum chromodynamic (QCD) calculations predict that at higher temperatures and densities there will be a transition of matter from the confined state to the deconfined state, as shown by the band between the double-lines. Research with the relativistic heavy ion collider (RHIC) will explore this transition of matter.

(11) Magnetized target fusion will require us to create the initial plasma configuration, inject it axially into a flux-conserving shell, and finally compress the plasma to fusion-relevant density and temperature. This image is a schematic of a proposed device designed to achieve these conditions.

(12) Because of parity violation, electrons observed in nature exhibit an asymmetry in their angular correlation with the nuclear spin direction. This asymmetry was first observed in the beta decay of cobalt-60 that was cooled to a low temperature and spin-aligned in a magnetic field.

(13) In a conventional transmission confocal microscope, light emerging from the sample is brought to focus on a pinhole aperture by a set of imaging optics. This aperture acts as a spatial filter for imaging, rejecting most of the light that did not pass through the confocal point in the sample volume, thereby reducing image contributions from light scattered or refracted from other locations within the medium.

(14) The ratio of $\bar{d}$ to $\bar{u}$ in the proton from the Fermi National Accelerator Laboratory (FNAL) E866 NuSea as a function of the fraction of the proton's momentum carried by the quark, x. NA51 (bright cross at center top) was the only previous measurement of this quantity. The curves represent various parameterizations of $\bar{d}/\bar{u}$. The curve that best matches the data (red line) was proposed only after the FNAL E866.

LA-13870-PR
Progress Report

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Physics Division Progress Report
January 1, 1999–December 31, 2000

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Physics Division Progress Report

January 1, 1999–December 31, 2000

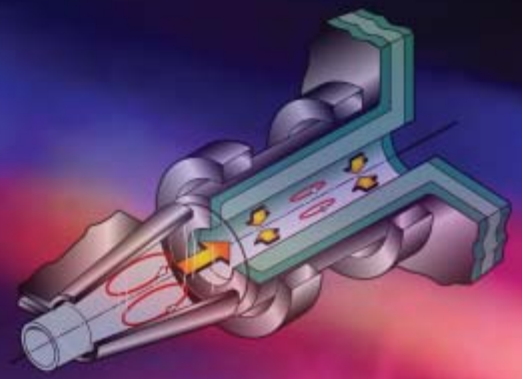
Abstract

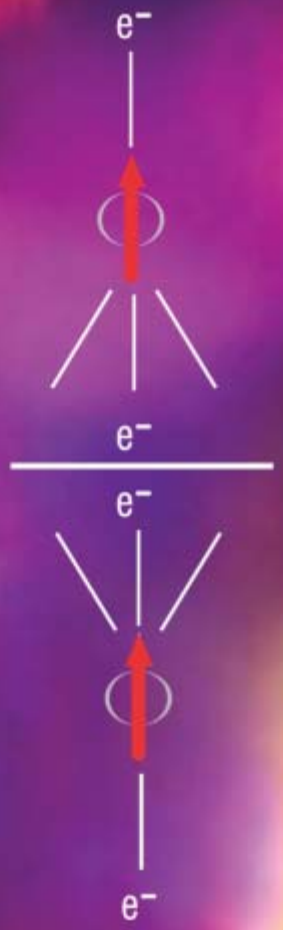
This Physics Division Progress Report describes our progress and achievements in applied and basic science during calendar years 1999 and 2000. The report covers the activities of the five Physics Division groups, which represent the main areas in which we serve Los Alamos National Laboratory and the nation: Biophysics, Hydrodynamic and X-Ray Physics, Neutron Science and Technology, Plasma Physics, and Subatomic Physics. The report also covers the activities of the Atlas Construction group (now disbanded) as it designed and built the most energetic pulsed-power facility in the world. This report includes a message from the Physics Division leader, general information about the mission and organization of the Division, staffing and funding data for the subject years, descriptions of the activities of each of our groups, highlights of the major research efforts throughout the Division, descriptions of the individual projects we support, and our publications and conference presentations for the subject years.

Contents

Note: Appendicies A and B are printed in a separate bound volume.

Physics





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